

## PATENT ABSTRACTS OF JAPAN

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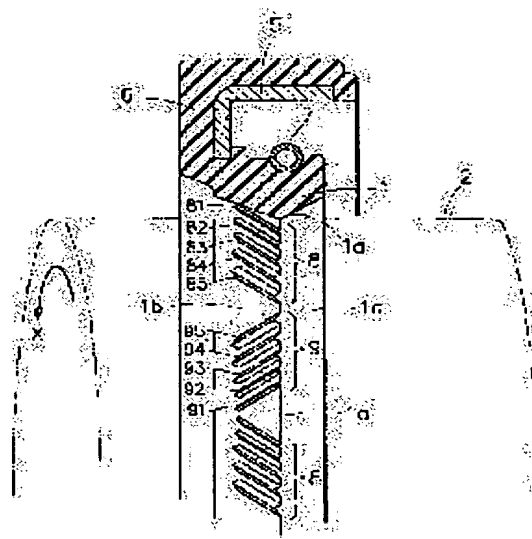
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## (54) OIL SEAL

## (57)Abstract:

PROBLEM TO BE SOLVED: To provide an oil seal enhancing oil sealing performance by efficiently returning oil tending to leak.

SOLUTION: This oil seal has a circular seal lip 1 having almost an wedge-shaped cross section, whose sharp end edge on the inner circumference side comes in contact with a shaft 2. Plural first rib groups 8 each comprising plural ribs 81, 82, etc., returning oil tending to leak when the shaft 2 rotates in one direction or relatively rotates and plural second rib groups 9 each comprising plural ribs 91, 92, etc., returning oil tending to leak when the shaft 2 reversely rotates or relatively rotates are alternately installed in the oil seal. The first rib group 8 is formed so as to change little by little the heights of ribs so that the ribs positioned on the front side in the rotation direction when the shaft 2 rotates in one direction or relatively rotates become gradually higher, and the second rib group 9 is formed so as to change little by little the heights of ribs so that the ribs positioned on the front side in the rotation direction when the shaft 2 reversely rotates or relatively rotates become gradually higher.



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CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL  
PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

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[Translation done.]

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**CLAIMS**


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[Claim(s)]

[Claim 1] The acute edge by the side of inner circumference is equipped with the annular seal lip of the cross-section \*\*\*\* wedge in contact with a shaft. The first rib group which consists of two or more ribs which return the oil which it is going to reveal when fixed spacing is opened and arranged to a hoop direction and a shaft rotates or rotates [ relative ] in an one direction to the atmospheric-air side slant face of this seal lip, The second rib group which consists of two or more ribs which return the oil which it is going to reveal when fixed spacing is opened and arranged to a hoop direction and a shaft rotates or rotates [ relative ] to hard flow is set to two or more \*\*\*\* beam oil seal by turns. Change the height of each rib little by little, and the above-mentioned first rib group is formed so that the rib located in the hand-of-cut they side when a shaft rotates or rotates [ relative ] in an one direction may become high. The above-mentioned second rib group is oil seal characterized by changing the height of each rib little by little, and having formed so that the rib located in the hand-of-cut they side when a shaft rotates or rotates [ relative ] to hard flow may become high.

[Claim 2] It is what said first rib group becomes from two or more ribs of the cross-section triangle which inclines in an upward slant to the right at a fixed include angle to the acute edge of said seal lip. The height of each rib is changed little by little, and it has formed so that the rib located in left-hand side along a hoop direction may become high. Said second rib group Oil seal according to claim 1 characterized by changing the height of each rib little by little, and having formed so that it may consist of two or more ribs of the cross-section triangle which inclines in a left riser at a fixed include angle to the acute edge of said seal lip and the rib located in right-hand side along a hoop direction may become high.

[Claim 3] Oil seal according to claim 1 or 2 characterized by for the higher rib having made large width of face of each rib of said first rib group, and a higher rib making large width of face of each rib of said second rib group.

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## DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the oil seal with the high oil seal engine performance with which a revolving shaft etc. is equipped.

[0002]

[Description of the Prior Art] Conventionally, the both-directions helix seal as shown in drawing 4 is known as oil seal with which a revolving shaft etc. is equipped.

[0003] This both-directions helix seal is the thing equipped with the annular seal lip 1 of the cross-section \*\*\*\* wedge with which acute edge 1a by the side of inner circumference contacts a shaft 2, and the first rib group 3 and the second rib group 4 are two or more \*\*\*\* eclipse \*\*\*\*\* by turns in atmospheric-air side slant-face 1b of this seal lip 1.

[0004] This first rib group 3 is what consists of rib 3a of two or more same height which opened and arranged fixed spacing to the hoop direction of atmospheric-air side slant-face 1b. When each rib 3a inclines, and is formed at the fixed include angle to acute edge 1a of a seal lip 1 and a shaft 2 rotated or rotates [ relative ] in the direction of an arrow head X, The oil (lubricating oil) which it is going to reveal from the contact part of a shaft 2 and seal-lip acute edge 1a can be returned now to an oil \*\* side by the pump action of each rib 3a.

[0005] Moreover, although it consists of rib 4a of two or more same height to which the second rib group 4 also opened and arranged fixed spacing to the hoop direction of atmospheric-air side slant-face 1b When such rib 4a inclines and is formed at the fixed include angle to seal-lip acute edge 1a so that the sense of an inclination may become opposite with rib 3a of the above-mentioned first rib group 3, and a shaft 2 rotated or rotates [ relative ] to an arrow head X and hard flow, The oil which it is going to reveal from the contact part of a shaft 2 and seal-lip acute edge 1a can be returned now to an oil \*\* side by the pump action of each rib 4a.

[0006]

[Problem(s) to be Solved by the Invention] However, like the above-mentioned helix seal, if each rib 4a of all of the second rib group 4 is also formed in the same height, each rib 3a of the first rib group 3 The contact pattern of each rib 3a of the first rib group 3 to a shaft 2 The protrusion dimension from the contact part of seal-lip acute edge 1a serves as the same equal pattern configuration so that it may expand to drawing 5 typically and may be shown. The contact pattern of each rib 4a of the second rib group 4 also serves as the same pattern configuration (the pattern configuration of the above-mentioned rib 3a, and pattern configuration of axial symmetry) where a protrusion dimension is equal.

[0007] When a shaft 2 rotated or rotates [ relative ] in the direction of an arrow head X, therefore, the oil revealed to an atmospheric-air side from the contact part of a shaft 2 and seal-lip acute edge 1a When it cannot catch by rib 3a of the beginning of the first rib group 3 and cannot return to an oil \*\* side The oil which caught oil, and it becomes impossible to have returned to the oil \*\* side, and was revealed also by rib 3a of the 2nd henceforth will be sent out by rib 4a of the following second rib group 4 to an atmospheric-air side. Such a phenomenon is similarly produced, when a shaft 2 rotated or rotates [ relative ] to hard flow.

[0008] Therefore, the above-mentioned helix seal had comparatively many leak rates of oil, and had the problem that the oil seal engine performance was not not much good.

[0009] The place which this invention was made that this problem should be coped with, and is made into the purpose is to offer oil seal, such as a helix seal which returned efficiently the oil which it is going to reveal and raised the oil seal engine performance.

[0010]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the oil seal concerning claim 1 of this invention The acute edge by the side of inner circumference is equipped with the annular seal lip of the cross-section \*\*\*\* wedge in contact with a shaft. The first rib group which consists of two or more ribs which return the oil which it is going to reveal when fixed spacing is opened and arranged to a hoop direction and a shaft rotates or rotates [ relative ] in an one direction to the atmospheric-air side slant face of this seal lip, The second rib group which consists of two or more ribs which return the oil which it is going to reveal when fixed spacing is opened and arranged to a hoop direction and a shaft rotates or rotates [ relative ] to hard flow is set to two or more \*\*\*\* beam oil seal by turns. Change the height of each rib little by little, and the above-mentioned first rib group is formed so that the rib located in the hand-of-cut they side when a shaft rotates or rotates [ relative ] in an one direction may become high. The above-mentioned second rib group is characterized by changing the height of each rib little by little, and having formed so that the rib located in the hand-of-cut they side may become high, when a shaft rotates or rotates [ relative ] to hard flow.

[0011] When the shaft a shaft "carries out [ a shaft ] relative rotation" in an one direction is fixed here and oil seal rotates the perimeter of a shaft to hard flow, and while a shaft rotates to an one direction, the case where oil seal

rotates to hard flow is meant.

[0012] Moreover, the oil seal concerning claim 2 of this invention It is what the first rib group becomes from two or more ribs of the cross-section triangle which inclines in an upward slant to the right at a fixed include angle to the acute edge of a seal lip in the oil seal of above-mentioned claim 1. The height of each rib is changed little by little, and it has formed so that the rib located in left-hand side along a hoop direction may become high. The second rib group It is characterized by changing the height of each rib little by little, and having formed so that it may consist of two or more ribs of the cross-section triangle which inclines in the Hidari riser at a fixed include angle to the acute edge of a seal lip and the rib located in right-hand side along a hoop direction may become high.

[0013] And oil seal concerning claim 3 of this invention is characterized by for the higher rib having made large width of face of each rib of the first rib group, and a higher rib making large width of face of each rib of the second rib group in above-mentioned claim 1 or the oil seal of 2.

[0014] Since the height of each rib is changed little by little and the first rib group of the oil seal of claim 1 forms it so that the rib located in the hand-of-cut they side may become high when a shaft rotates or rotates [ relative ] in an one direction, as for the contact pattern of each rib to a shaft, the rib located in a hand-of-cut they side serves as the pattern configuration where the protrusion dimension from the contact part of the seal-lip acute edge is large. Therefore, the oil which it is going to reveal from the contact part of a shaft and the seal-lip acute edge to an atmospheric-air side It catches with the first rib with smallest height of a rib and protrusion dimension of a contact pattern. Even when it cannot return by that pump action, oil is caught one by one with the rib 2nd after a hand-of-cut they [ than this rib ] side with little by little larger height and protrusion dimension of a contact pattern. Since oil can almost all finally be caught with the rib of the last by the side of hand-of-cut them with largest height of a rib and protrusion dimension of a contact pattern and it can return to an oil \*\* side efficiently, the oil seal engine performance in case a shaft rotates or rotates [ relative ] in an one direction improves.

[0015] The second rib group moreover, by changing the height of each rib little by little, and forming it so that the rib located in the hand-of-cut they side when a shaft rotates or rotates [ relative ] to hard flow may become high In order to make it be the contact pattern configuration where the protrusion dimension from the seal-lip acute edge is large, in the rib located in a hand-of-cut they side, According to the same operation as the above, the oil which it is going to reveal when a shaft rotates or rotates [ relative ] to hard flow can be efficiently returned to an oil \*\* side, and the oil seal engine performance can be raised.

[0016] As for the first rib group and the second rib group, it is specifically desirable to consider as a configuration like the first rib group of the oil seal of claims 2 and 3 and the second rib group.

[0017]

[Embodiment of the Invention] Hereafter, with reference to a drawing, the concrete operation gestalt of this invention is explained in full detail.

[0018] The fragmentary sectional view of the shaft orientations of the oil seal which drawing 1 requires for 1 operation gestalt of this invention, and drawing 2 are the explanatory views in which expanding the contact pattern of this oil seal, and showing it typically.

[0019] This operation gestalt is what illustrated the both-directions helix seal, it can be burned on the annular rodding 5 of a cross-section L typeface so that the elastic bodies 6, such as rubber, may win this rodding 5, and the annular seal lip 1 is formed in the inner circumference side of an elastic body 6.

[0020] This seal lip 1 is formed in the annular seal lip of the cross-section \*\*\*\* wedge equipped with atmospheric-air side slant-face 1b which inclines in the reverse sense mutually, and oil side slant-face 1c, and acute edge 1a by the side of inner circumference is energized with the garter spring 7 of a seal-lip periphery inside, and touches the shaft 2. And the first rib group 8 and the second rib group 9 by which it is characterized [ of this invention ] at atmospheric-air side slant-face 1b of this seal lip 1 are two or more \*\*\*\* eclipse \*\*\*\*\* by turns.

[0021] This first rib group 8 is two or more ribs 81 of the cross-section triangle which opened and arranged fixed spacing to the hoop direction of atmospheric-air side slant-face 1b, and the thing which consists of 82 —. When each rib is inclined and formed in the upward slant to the right at the fixed include angle to acute edge 1a of a seal lip 1 and a shaft 2 rotated or rotates [ relative ] in the direction of an arrow head X, The oil (lubricating oil) which it is going to reveal from the contact part of a shaft 2 and seal-lip acute edge 1a can be returned now to an oil \*\* side by the pump action of each rib. The rib 81 of this first rib group 8, and 82 — so that the rib located in that hand-of-cut they side when a shaft 2 rotates or rotates [ relative ] in the direction of arrow-head X may become high That is, they are each ribs 81 and 82 so that the rib located in left-hand side along a hoop direction may become high. — Change height little by little and it is formed. The rib 85 of the last by the side of hand-of-cut them who are located most in left-hand side along a hoop direction is the most expensive, the first rib 81 located in the method side of method Kogo of rotation (a hoop direction is met and it is right-hand side) is the lowest, and it is \*\*\*\*\*. And the width of face of a rib is widely formed by the higher rib, the width of face of the first lowest rib 81 is the narrowest, the width of face is the widest and the rib 85 of the highest last by the side of hand-of-cut them is formed.

[0022] Moreover, although it consists of two or more ribs 91 of a cross-section triangle with which the second rib group 9 also opened and arranged fixed spacing to the hoop direction of atmospheric-air side slant-face 1b, and 92 — When each rib is inclined and formed in the Hidari riser at the fixed include angle to acute edge 1a of a seal lip 1 and a character 2 rotated or rotates [ relative ] to the direction of arrow-head X, and hard flow, The oil which it is going to reveal from the contact part of a shaft 2 and seal-lip acute edge 1a can be returned now to an oil \*\* side by the pump action of each rib. The rib 91 of this second rib group 9, and 92 — so that the rib located in that hand-of-cut tip side when a shaft 2 rotates or rotates [ relative ] to the direction of arrow-head X and hard flow may become high That is, they are each ribs 91 and 92 so that the rib located in right-hand side along a hoop direction may become high. — Change height little by little and it is formed. Rib 95 \*\*\*\* of the last by the side of hand-of-cut them who are located most in right-hand side along a hoop direction is also high, and the first rib 91 located in the method side of method Kogo of rotation (a hoop direction is met and it is left-hand side) is the lowest. And the

width of face of a rib is widely formed by the higher rib, the width of face of the first lowest rib 91 is the narrowest, the width of face is the widest and the rib 95 of the last of the highest last by the side of hand-of-cut them is formed.

[0023] When the first rib group 8 and the second rib group 9 are constituted as mentioned above, each rib 81 of the first rib group 8 to a shaft 2 and 82 — a contact pattern As shown in drawing 2, the rib located in the hand-of-cut they side of an arrow head X serves as the shape of a triangle with the large protrusion dimension from the contact part of seal-lip acute edge 1a. The protrusion dimension of the contact pattern of the first rib 81 is the smallest, and the protrusion dimension of the contact pattern of the rib 85 of the last by the side of hand-of-cut them becomes the largest. Therefore, the oil which it is going to reveal to an atmospheric-air side from the contact part of a shaft 2 and seal-lip acute edge 1a when a shaft 2 rotated or rotates [ relative ] in the direction of arrow-head X Even when it cannot catch with the first rib 81 with smallest height of a rib and protrusion dimension of a contact pattern and cannot return to an oil \*\* side by the pump action Oil is caught one by one with the ribs 82, 83, and 84 2nd after a hand-of-cut they [ than this rib 81 ] side with little by little larger height and protrusion dimension of a contact pattern. Since oil can almost all finally be caught with the rib 85 of the last by the side of hand-of-cut them with largest height of a rib and protrusion dimension of a contact pattern and it can return to an oil \*\* side efficiently, the oil seal engine performance in case a shaft 2 rotates or rotates [ relative ] in the direction of arrow-head X improves.

[0024] Similarly, they are each ribs 91 and 92 of the second rib group 9. — As a contact pattern is also shown in drawing 2 The rib located in a hand-of-cut they side contrary to the direction of arrow-head X serves as the shape of a triangle with the large protrusion dimension from the contact part of seal-lip acute edge 1a. Since the protrusion dimension of the contact pattern of the first rib 91 is the smallest and the protrusion dimension of the contact pattern of the rib 95 of the last by the side of hand-of-cut them becomes the largest According to the same operation as the case of the above-mentioned first rib group 8, the oil which it is going to reveal when a shaft 2 rotates or rotates [ relative ] to hard flow can be efficiently returned to an oil \*\* side, and the oil seal engine performance can be raised.

[0025] Although the number of the rib of the first rib group 8 and the second rib group 9 is made into five in the oil seal of the above-mentioned operation gestalt, respectively, even if [ than this ] more, a thing good at least cannot be overemphasized.

[0026] Moreover, although not limited especially about the height of a rib, it is desirable to give a difference little by little and to form a rib so that it may fall within the range whose height of all ribs is 30 micrometers of abbreviation — and 200 micrometers of abbreviation. It is because it will produce un-arranging [ of originating in contact of the hoop direction to the shaft of a rib (lip) becoming discontinuity, and becoming easy to generate the so-called lip piece phenomenon ] if the amount of return of the oil by the pump action of a rib (the amount of pumps) will decrease if the height of a rib becomes lower than this range, and it becomes higher than this range.

[0027] Furthermore, like the oil seal shown in drawing 3, each rib 91 of each rib 81 of the first rib group 8, 82 —, and the second rib group 9 and 92 — may be formed in the inclination rib with which the height of a rib increases gradually, so that it separates from the seal-lip acute edge 1a side. By this, reduction of the contact width of face of a rib can be controlled as wear of each rib advances, and the seal engine performance of oil seal can be raised further. In addition, since other configurations of the oil seal of this drawing 3 are the same as that of the oil seal of drawing 1 mentioned above, in drawing 3, the same sign is given to the same member, and explanation is omitted.

[0028]

[Effect of the Invention] When a shaft rotates or rotates [ relative ] to an one direction or hard flow, the oil seal of this invention catches the oil which it is going to reveal from the contact part of a shaft and the seal-lip acute edge to an atmospheric-air side with each rib with which the sequential height of the first rib group or the second rib group differs, returns it to an oil \*\* side efficiently by the pump action, and does so the remarkable effectiveness that the oil seal engine performance can be raised, so that clearly from the above explanation.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the fragmentary sectional view of the shaft orientations of the oil seal concerning 1 operation gestalt of this invention.

[Drawing 2] It is the explanatory view in which expanding the contact pattern of this oil seal, and showing it typically.

[Drawing 3] It is the fragmentary sectional view of the shaft orientations of the oil seal concerning other operation gestalten of this invention.

[Drawing 4] It is the outline fragmentary sectional view of the shaft orientations of the conventional both-directions helix seal.

[Drawing 5] It is the explanatory view in which expanding the contact pattern of this helix seal, and showing it typically.

[Description of Notations]

1 Seal Lip.

1a Acute tip

1b Atmospheric-air side slant face

2 Shaft

5 Annular Rodding

6 Elastic Body

7 Garter Spring

8 First Rib Group

81, 82, 83, 84, 85 Rib of the first rib group

9 Second Rib Group

91, 92, 93, 94, 95 Rib of the second rib group

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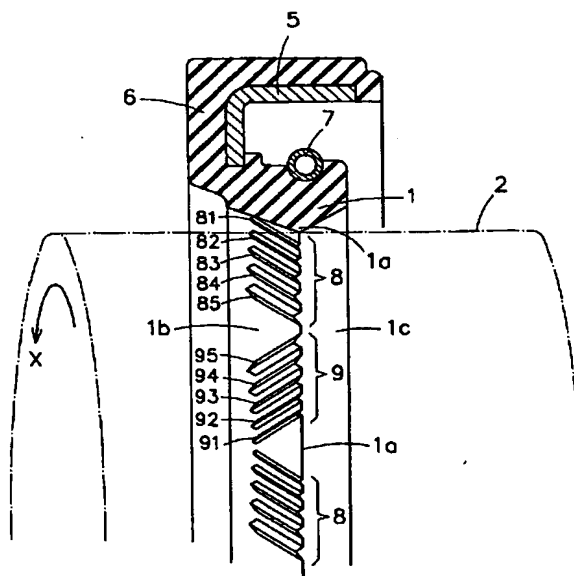
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(54)【発明の名称】 オイルシール

(57)【要約】

【課題】 漏洩しようとするオイルを効率良く戻してオイル密封性能を向上させたオイルシールを提供する。

【解決手段】 内周側の先鋭端縁1aが軸2に接触する断面はば楔形の環状のシールリップ1を備え、その大気側斜面1bに、軸2が一方方向に回転又は相対回転するとき漏洩しようとするオイルを戻す複数のリップ81、82…からなる第一リップ群8と、軸2が逆方向に回転又は相対回転するとき漏洩しようとするオイルを戻す複数のリップ91、92…からなる第二リップ群9とを交互に複数群設けたオイルシールにおいて、第一リップ群8は、軸2が一方方向に回転又は相対回転するときその回転方向先方側に位置するリップほど高くなるように各リップの高さを少しずつ変えて形成し、第二リップ群9は、軸2が逆方向に回転又は相対回転するときその回転方向先方側に位置するリップほど高くなるように各リップの高さを少しずつ変えて形成した構成とする。





## 【特許請求の範囲】

【請求項1】 内周側の先鋭端縁が軸に接触する断面はば楔形の環状のシールリップを備え、このシールリップの大気側斜面に、周方向に一定間隔をあけて配列し且つ軸が一方方向に回転又は相対回転するとき漏洩しようとするオイルを戻す複数のリブからなる第一リブ群と、周方向に一定間隔をあけて配列し且つ軸が逆方向に回転又は相対回転するとき漏洩しようとするオイルを戻す複数のリブからなる第二リブ群とを交互に複数群設けたオイルシールにおいて、

上記第一リブ群は、軸が一方方向に回転又は相対回転するときその回転方向先方側に位置するリブほど高くなるように各リブの高さを少しずつ変えて形成してあり、上記第二リブ群は、軸が逆方向に回転又は相対回転するときその回転方向先方側に位置するリブほど高くなるように各リブの高さを少しずつ変えて形成してあることを特徴とするオイルシール。

【請求項2】 前記第一リブ群が、前記シールリップの先鋭端縁に対し一定角度で右上がりに傾斜する断面三角形の複数のリブからなるもので、周方向に沿って左側に位置するリブほど高くなるように各リブの高さを少しずつ変えて形成してあり、前記第二リブ群は、前記シールリップの先鋭端縁に対し一定角度で左上がりに傾斜する断面三角形の複数のリブからなるもので、周方向に沿って右側に位置するリブほど高くなるように各リブの高さを少しずつ変えて形成してあることを特徴とする請求項1に記載のオイルシール。

【請求項3】 前記第一リブ群の各リブの幅を高いリブほど広くし、前記第二リブ群の各リブの幅も高いリブほど広くしたことを特徴とする請求項1又は請求項2に記載のオイルシール。

## 【発明の詳細な説明】

【0001】

【発明の属する技術分野】 本発明は、回転軸などに装着されるオイル密封性能の高いオイルシールに関する。

【0002】

【従来の技術】 従来より、回転軸等に装着されるオイルシールとして、図4に示すような両方向ヘリックスシールが知られている。

【0003】 この両方向ヘリックスシールは、内周側の先鋭端縁1aが軸2に接触する断面はば楔形の環状のシールリップ1を備えたもので、このシールリップ1の大気側斜面1bには、第一リブ群3と第二リブ群4とが交互に複数群設けられている。

【0004】 この第一リブ群3は、大気側斜面1bの周方向に一定間隔をあけて配列した複数の同じ高さのリブ3aからなるもので、各リブ3aはシールリップ1の先鋭端縁1aに対して一定角度で傾斜して形成されており、軸2が矢印Xの方向に回転又は相対回転したとき、軸2とシールリップ先鋭端縁1aとの接触箇所から漏洩

しようとするオイル（潤滑油）を各リブ3aのポンプ作用によってオイル溜側へ戻すことができるようになって

【0005】 また、第二リブ群4も、大気側斜面1bの周方向に一定間隔をあけて配列した複数の同じ高さのリブ4aからなるものであるが、これらのリブ4aは上記第一リブ群3のリブ3aとは傾斜の向きが反対となるようにシールリップ先鋭端縁1aに対して一定角度で傾斜して形成されており、軸2が矢印Xと逆方向に回転又は相対回転したとき、軸2とシールリップ先鋭端縁1aとの接触箇所から漏洩しようとするオイルを各リブ4aのポンプ作用によってオイル溜側へ戻すことができるようになっている。

【0006】

【発明が解決しようとする課題】 しかしながら、上記のヘリックスシールのように、第一リブ群3の各リブ3aも第二リブ群4の各リブ4aも全て同じ高さに形成されていると、軸2に対する第一リブ群3の各リブ3aの接触パターンは、図5に模式的に拡大して示すように、シールリップ先鋭端縁1aの接触部分からの突出寸法が等しい同一のパターン形状となり、第二リブ群4の各リブ4aの接触パターンも、突出寸法が等しい同一のパターン形状（上記リブ3aのパターン形状と線対称のパターン形状）となる。

【0007】 そのため、軸2が矢印Xの方向に回転又は相対回転したとき、軸2とシールリップ先鋭端縁1aとの接触箇所から大気側へ漏洩するオイルを、第一リブ群3の最初のリブ3aで受け止めてオイル溜側へ戻すことができない場合は、2番目以降のリブ3aによってもオイルを受け止めてオイル溜側へ戻すことができなくなり、漏洩したオイルは次の第二リブ群4のリブ4aによって大気側へ送り出されることになる。このような現象は、軸2が逆方向に回転又は相対回転した場合にも同様に生ずる。

【0008】 従って、上記のヘリックスシールは、オイルの漏洩量が比較的多く、オイル密封性能があまり良くないという問題があった。

【0009】 本発明は斯かる問題に対処すべくなされたもので、その目的とするところは、漏洩しようとするオイルを効率良く戻してオイル密封性能を高めたヘリックスシール等のオイルシールを提供することにある。

【0010】

【課題を解決するための手段】 上記目的を達成するため、本発明の請求項1に係るオイルシールは、内周側の先鋭端縁が軸に接触する断面はば楔形の環状のシールリップを備え、このシールリップの大気側斜面に、周方向に一定間隔をあけて配列し且つ軸が一方方向に回転又は相対回転するとき漏洩しようとするオイルを戻す複数のリブからなる第一リブ群と、周方向に一定間隔をあけて配列し且つ軸が逆方向に回転又は相対回転するとき漏洩し

ようとするオイルを戻す複数のリブからなる第二リブ群とを交互に複数群設けたオイルシールにおいて、上記第一リブ群は、軸が一方向に回転又は相対回転するときその回転方向先方側に位置するリブほど高くなるように各リブの高さを少しずつ変えて形成してあり、上記第二リブ群は、軸が逆方向に回転又は相対回転するときその回転方向先方側に位置するリブほど高くなるように各リブの高さを少しずつ変えて形成してあることを特徴とする。

【0011】ここに、軸が一方向に「相対回転する」とは、軸が固定されオイルシールが軸の周囲を逆方向に回転する場合、及び、軸が一方向に回転すると共にオイルシールが逆方向に回転する場合を意味する。

【0012】また、本発明の請求項2に係るオイルシールは、上記請求項1のオイルシールにおいて、その第一リブ群が、シールリップの先鋭端縁に対し一定角度で右上がりに傾斜する断面三角形の複数のリブからなるもので、周方向に沿って左側に位置するリブほど高くなるように各リブの高さを少しずつ変えて形成してあり、第二リブ群は、シールリップの先鋭端縁に対し一定角度で左上がりに傾斜する断面三角形の複数のリブからなるもので、周方向に沿って右側に位置するリブほど高くなるように各リブの高さを少しずつ変えて形成してあることを特徴とする。

【0013】そして、本発明の請求項3に係るオイルシールは、上記請求項1又は2のオイルシールにおいて、その第一リブ群の各リブの幅を高いリブほど広くし、第二リブ群の各リブの幅も高いリブほど広くしたことを特徴とする。

【0014】請求項1のオイルシールの第一リブ群は、軸が一方向に回転又は相対回転するときその回転方向先方側に位置するリブほど高くなるように各リブの高さを少しずつ変えて形成しているため、軸に対する各リブの接触パターンは、回転方向先方側に位置するリブほどシールリップ先鋭端縁の接触部分からの突出寸法が大きいパターン形状となる。従って、軸とシールリップ先鋭端縁との接触箇所から大気側へ漏洩しようとするオイルを、リブの高さ及び接触パターンの突出寸法が最も小さい最初のリブで受け止め、そのポンプ作用で戻すことができない場合でも、このリブより高さ及び接触パターンの突出寸法が少しずつ大きい回転方向先方側の2番目以降のリブでオイルを順次受け止め、最終的にリブの高さ及び接触パターンの突出寸法が最も大きい回転方向先方側の最後のリブでオイルを殆ど残らず受け止めてオイル溜側へ効率良く戻すことができるので、軸が一方向に回転又は相対回転するときのオイル密封性能が向上する。

【0015】また、第二リブ群は、軸が逆方向に回転又は相対回転するときその回転方向先方側に位置するリブほど高くなるように各リブの高さを少しずつ変えて形成することにより、回転方向先方側に位置するリブほどシ

ールリップ先鋭端縁からの突出寸法が大きい接触パターン形状となるようにしてあるため、上記と同様の作用によって、軸が逆方向に回転又は相対回転するとき漏洩しようとするオイルを効率良くオイル溜側へ戻し、オイル密封性能を向上させることができる。

【0016】第一リブ群及び第二リブ群は、具体的には請求項2、3のオイルシールの第一リブ群及び第二リブ群のような構成とすることが望ましい。

【0017】

10 【発明の実施の形態】以下、図面を参照して本発明の具体的な実施形態を詳述する。

【0018】図1は本発明の一実施形態に係るオイルシールの軸方向の部分断面図、図2は同オイルシールの接触パターンを拡大して模式的に示す説明図である。

【0019】この実施形態は両方向ヘリックスシールを例示したもので、断面L字形の環状芯金5にはゴム等の弾性体6が該芯金5を抱き込むように焼き付けられており、弾性体6の内周側には環状のシールリップ1が形成されている。

20 【0020】このシールリップ1は、互いに逆向きに傾斜する大気側斜面1bとオイル側斜面1cとを備えた断面ほぼ楔形の環状のシールリップに形成され、内周側の先鋭端縁1aがシールリップ外周のガータスプリング7で内側へ付勢されて軸2に接触している。そして、このシールリップ1の大気側斜面1bには、本発明の特徴とする第一リブ群8と第二リブ群9が交互に複数群設けられている。

【0021】この第一リブ群8は、大気側斜面1bの周方向に一定間隔をあけて配列した断面三角形の複数のリブ81、82…からなるもので、各リブはシールリップ1の先鋭端縁1aに対し一定角度で右上がりに傾斜して形成されており、軸2が矢印Xの方向に回転又は相対回転したとき、軸2とシールリップ先鋭端縁1aとの接触箇所から漏洩しようとするオイル（潤滑油）を各リブのポンプ作用によってオイル溜側へ戻すことができるようになっている。この第一リブ群8のリブ81、82…は、軸2が矢印X方向に回転又は相対回転するときその回転方向先方側に位置するリブほど高くなるように、即ち、周方向に沿って左側に位置するリブほど高くなるように、各リブ81、82…の高さを少しずつ変えて形成されており、周方向に沿って最も左側に位置する回転方向先方側の最後のリブ85が最も高く、回転方向後方側（周方向に沿って右側）に位置する最初のリブ81が最も低くなっている。そして、リブの幅は、高いリブほど広く形成されており、最も低い最初のリブ81はその幅が最も狭く、回転方向先方側の最も高い最後のリブ85はその幅が最も広く形成されている。

【0022】また、第二リブ群9も、大気側斜面1bの周方向に一定間隔を開けて配列した断面三角形の複数のリブ91、92…からなるものであるが、各リブはシー

ルリップ1の先鋭端縁1aに対し一定角度で左上がりに傾斜して形成されており、字2が矢印X方向と逆方向に回転又は相対回転したとき、軸2とシールリップ先鋭端縁1aとの接触箇所から漏洩しようとするオイルを各リップのポンプ作用によってオイル溜側へ戻すことができるようになっている。この第二リップ群9のリップ91、92…は、軸2が矢印X方向と逆方向に回転又は相対回転するときその回転方向先端側に位置するリップほど高くなるように、即ち、周方向に沿って右側に位置するリップほど高くなるように、各リップ91、92…の高さを少しずつ変えて形成されており、周方向に沿って最も右側に位置する回転方向先側の最後のリップ95最も高く、回転方向後側（周方向に沿って左側）に位置する最初のリップ91が最も低くなっている。そして、リップの幅は、高いリップほど広く形成されており、最も低い最初のリップ91はその幅が最も狭く、回転方向先側の最も高い最後の最後のリップ95はその幅が最も広く形成されている。

【0023】第一リップ群8及び第二リップ群9を上記のように構成すると、軸2に対する第一リップ群8の各リップ81、82…の接触パターンは、図2に示すように、矢印Xの回転方向先側に位置するリップほどシールリップ先鋭端縁1aの接触部分からの突出寸法が大きい三角形形状となり、最初のリップ81の接触パターンの突出寸法が最も小さく、回転方向先側の最後のリップ85の接触パターンの突出寸法が最も大きくなる。従って、軸2が矢印X方向に回転又は相対回転したとき軸2とシールリップ先鋭端縁1aとの接触箇所から大気側へ漏洩しようとするオイルを、リップの高さ及び接触パターンの突出寸法が最も小さい最初のリップ81で受け止めてポンプ作用によりオイル溜側へ戻すことができない場合でも、このリップ81より高さ及び接触パターンの突出寸法が少しずつ大きい回転方向先側の2番目以降のリップ82、83、84でオイルを順次受け止め、最終的にリップの高さ及び接触パターンの突出寸法が最も大きい回転方向先側の最後のリップ85でオイルを殆ど残らず受け止めてオイル溜側へ効率良く戻すことができるので、軸2が矢印X方向に回転又は相対回転するときのオイル密封性能が向上する。

【0024】同様に、第二リップ群9の各リップ91、92…の接触パターンも、図2に示すように、矢印X方向と逆の回転方向先側に位置するリップほど、シールリップ先鋭端縁1aの接触部分からの突出寸法が大きい三角形形状となり、最初のリップ91の接触パターンの突出寸法が最も小さく、回転方向先側の最後のリップ95の接触パターンの突出寸法が最も大きくなるので、上記の第一リップ群8の場合と同様の作用によって、軸2が逆方向に回転又は相対回転するとき漏洩しようとするオイルを効率良くオイル溜側へ戻し、オイル密封性能を向上させることができる。

【0025】上記実施形態のオイルシールでは、第一リ

ップ群8及び第二リップ群9のリップの本数をそれぞれ5本としているが、これより多くても少なくともよいことは言うまでもない。

【0026】また、リップの高さについては特に限定されないが、全てのリップの高さが略30 $\mu$ m～略200 $\mu$ mの範囲内に収まるように少しずつ差をつけてリップを形成することが望ましい。リップの高さがこの範囲より低くなると、リップのポンプ作用によるオイルの戻し量（ポンプ量）が減少し、この範囲より高くなると、リップ（リップ）の軸に対する周方向の接触が不連続になることに起因して、いわゆるリップ切れ現象が発生しやすくなるといった不都合を生じるからである。

【0027】さらに、図3に示すオイルシールのように、第一リップ群8の各リップ81、82…、及び、第二リップ群9の各リップ91、92…を、シールリップ先鋭端縁1a側から離れるほど徐々にリップの高さが増大する傾斜リップに形成してもよい。これによって、各リップの摩耗が進行するにつれてリップの接触幅の減少を抑制して、オイルシールの密封性能を更に向上させることができる。

尚、この図3のオイルシールの他の構成は前述した図1のオイルシールと同様であるので、図3において同一部材に同一符号を付し、説明を省略する。

【0028】

【発明の効果】以上の説明から明らかなように、本発明のオイルシールは、軸が一方向又は逆方向に回転又は相対回転するときに、軸とシールリップ先鋭端縁との接触部分から大気側へ漏洩しようとするオイルを、第一リップ群又は第二リップ群の順次高さが異なる各リップで受け止めてそのポンプ作用により効率良くオイル溜側へ戻し、オイル密封性能を向上させることができるといった顕著な効果を奏する。

【図面の簡単な説明】

【図1】本発明の一実施形態に係るオイルシールの軸方向の部分断面図である。

【図2】同オイルシールの接触パターンを拡大して模式的に示す説明図である。

【図3】本発明の他の実施形態に係るオイルシールの軸方向の部分断面図である。

【図4】従来の両方向ヘリックスシールの軸方向の概略部分断面図である。

【図5】同ヘリックスシールの接触パターンを拡大して模式的に示す説明図である。

【符号の説明】

1 シールリップ

1a 先鋭先端

1b 大気側斜面

2 軸

5 環状芯金

6 弾性体

7 ガータスプリング

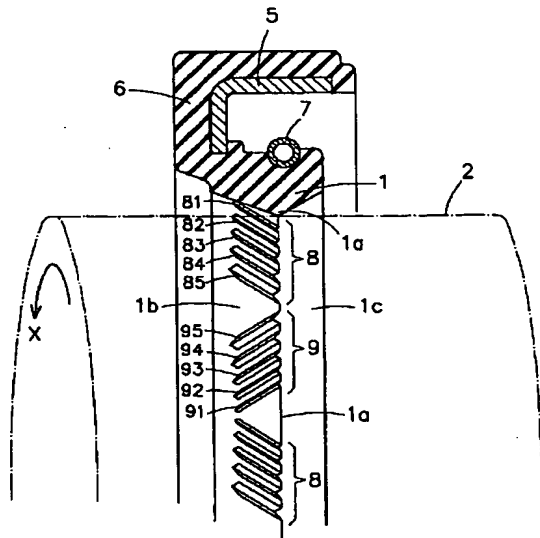
8 第一リブ群

\* 9 第二リブ群

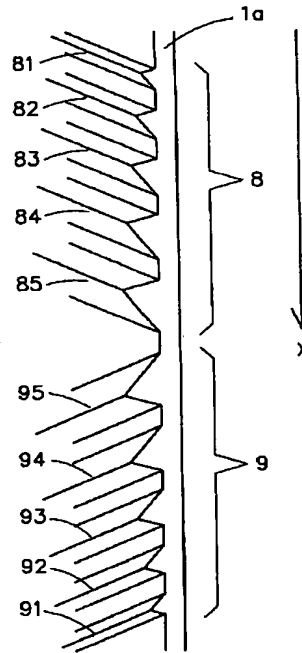
81, 82, 83, 84, 85 第一リブ群のリブ

\* 91, 92, 93, 94, 95 第二リブ群のリブ

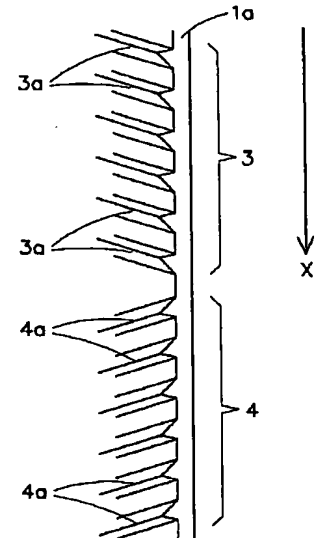
【図1】



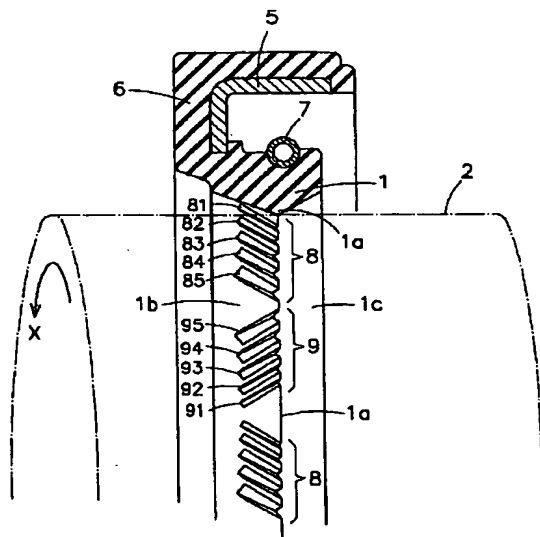
【図2】



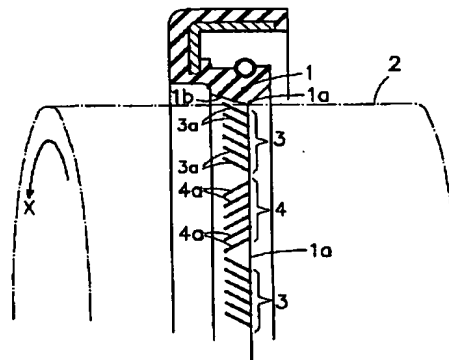
【図5】



【図3】



【図4】



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